Elementary Algebra

Prerequisite: Mastery of Pre-algebra

Course Description

Students in Elementary Algebra will learn algebra as a style of thinking for formalizing patterns, functions, and generalizations. In this course, students will expand previously learned quantitative rational number relationships to include the irrational numbers. The focus will be on proficiency in recognizing and working effectively with linear relationships and their corresponding representations in tables, graphs, and equations; such proficiency includes competence in solving linear equations, generating equivalent expressions, using formulas, and applying proportionality. To help develop proficiency in symbolic and graphical representations, students will use physical models, visual models, and technology. While mathematical skills will be developed, teaching will focus on the understanding of concepts in depth, enabling students to apply mathematical skills and make meaningful connections to life's experiences.

Elementary Algebra

Standard 1: Students will acquire number sense and perform operations with real numbers.

Objective 1.1: Compute fluently and make reasonable estimates.

a. Evaluate and simplify numerical expressions containing real numbers using the order of operations.
b. Compute solutions to problems and determine the reasonableness of an answer by relating them to the problem.

Objective 1.2: Represent real numbers in a variety of ways.

a. Compare and order real numbers.
b. Choose appropriate and convenient forms of real numbers for solving problems and representing answers, e.g., radical form, multiples of pi, decimal, fraction, or percent.

Objective 1.3: Identify relationships among real numbers and operations involving these numbers.

a. Classify numbers as rational or irrational in the real number system.
b. Relate properties and operations of rational numbers to those used with irrational numbers.

Standard 2: Students will represent and analyze mathematical situations and properties using patterns, relations, functions, and algebraic symbols.

Objective 2.1: Use patterns, relations, and functions to represent mathematical situations.

a. Write algebraic expressions or equations to generalize visual patterns, numerical patterns, relations, data sets, or scatter plots.
b. Represent linear equations in slope-intercept form, $y = mx + b$, or standard form, $Ax + By = C$.
c. Distinguish between linear and non-linear functions by examining a table, equation, or graph.
d. Identify the slope of a linear function as an average rate of change in real-world situations.
e. Determine whether a relation is a function when given a graph or set of ordered pairs.

Objective 2.2: Evaluate, solve, and analyze mathematical situations using algebraic properties and symbols.

a. Solve real-world problems involving constant rates of change, e.g., rates of travel, hourly wages, or rates of interest.
b. Solve multi-step equations and inequalities:
   - Numerically; e.g., from a table.
   - Algebraically, including the use of manipulatives.
   - Graphically.
   - Using technology.
c. Solve systems of two linear equations or inequalities:
   - Numerically; e.g., from a table.
   - Algebraically.
   - Graphically.
   - Using technology.
d. Determine the number of possible solutions for a system of two linear equations.
e. Simplify and evaluate numerical expressions (including integer exponents and square roots), algebraic expressions, formulas, and equations.
f. Solve linear formulas and literal equations for a specified variable, e.g., solve for p in $I = prt$.
g. Solve proportions that include algebraic first-degree expressions.
h. Determine whether two lines are parallel, perpendicular, or neither when given the equations.

Objective 2.3: Represent quantitative relationships using mathematical models and symbols.

a. Identify the slope of a line when given:
   - A set of ordered pairs.
   - The graph of a linear relation or function.
   - The equation of a linear relation or function.
   - A table of values.
b. Write the equation of a line when given:
   - A set of ordered pairs.
   - The slope and a point on the line.
   - The graph of a line.
c. Identify horizontal and vertical lines given the equations.
d. Identify the domain and range of a relation or function when given a graph, equation, table, or set of ordered pairs.
e. Determine the effect of parameter changes on the graphs of linear relations and functions.
f. Identify the x- and y-intercepts from an equation or graph of a line or a table of values.
g. Graph linear relations and functions:
   - By plotting points.
   - By finding x- and y-intercepts.
   - Using the slope-intercept form of a line.
   - Using the slope and any point on the line.
h. Solve and graph a system of linear inequalities and identify the boundary lines and solution area.
i. Determine and explain the meaning of intercepts using real-world examples.
j. Use direct variation to model rates of change, e.g., if income = 40 hours times rate of pay, then increasing the rate of pay increases income.

<table>
<tr><td colspan="3">Standard 3: Students will solve problems using spatial and logical reasoning, applications of geometric principles, and modeling.</td></tr>
<tr><td></td><td>Objective 3.2: Specify locations and describe spatial relationships using coordinate geometry.
a. Find the distance between two given points and find the coordinates of the midpoint between them.
b. Solve problems using the distance formula.
c. Solve problems for areas and perimeters.
d. Solve problems for areas and circumferences of circles.</td><td>Objective 3.3: Solve problems using visualization, spatial reasoning, and geometric modeling.
a. Solve problems using the Pythagorean Theorem.
b. Find missing parts of geometric figures using proportional reasoning and geometric relationships.
c. Multiply polynomials using the distributive property, area models, and other methods, e.g., $(a + b)^2$, $x(x + 2)$, or $(x + a)(x + b)$.
d. Factor polynomials using a variety of methods.
• To identify the greatest common monomial factor.
• Of the form $ax^2 + bx + c$ when $a = 1$.</td></tr>
<tr><td colspan="3">Standard 4: Students will understand and apply measurement tools, formulas, and techniques.</td></tr>
<tr><td>Objective 4.1: Understand measurable attributes of objects and the units, systems, and processes of measurement.
a. Measure lengths of designated sides of geometric figures and calculate area and volume using the correct units.
b. Calculate derived measures using formulas, e.g., areas, volumes, surface areas.
c. Express the rate of change as a ratio of two different measures.
d. Convert unit measures within a system, e.g., feet to inches, liters to milliliters.
e. Use a variety of estimation strategies to determine the reasonableness of answers.</td><td></td><td></td></tr>
<tr><td colspan="3">Standard 5: Students will draw conclusions using concepts of probability after collecting, organizing, and analyzing a data set.</td></tr>
<tr><td>Objective 5.1: Formulate and answer questions by collecting, organizing, and analyzing data.
a. Collect, record, organize, and display a set of data.
b. Determine whether the pattern of the data is linear or nonlinear when given in a list, table, or graph.
c. Interpret the correlation between two variables as positive, negative, or having no correlation.
d. Find a line of best fit by estimation, choosing two points, or using technology for a given set of data.
e. Analyze the meaning of the slope and y-intercept of a line of best fit as it relates to the data.
f. Make predictions based on a line of best fit.
g. Find mean, median, mode, and range for a data set.</td><td>Objective 5.2: Apply basic concepts of probability.
a. Determine and express the probability of an event as a fraction, percent, ratio, or decimal.
b. Compute simple probabilities using the Fundamental Counting Principle or a tree diagram.
c. Identify the probability of an event as being between zero (event not possible) and one (event certain).
d. Recognize that the sum of the probability of an event and the probability of its complement is equal to one.
e. Determine whether a game or process is fair.</td><td></td></tr>
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